

Milking Frequency

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The majority of present dairy owners and managers probably think that the milking frequency and schedule on the majority of North American dairy farms in the past was twice a day milking at approximately 12-hour intervals. In fact, many variations in milking frequency or different lengths of inter-milking intervals have been tried over the last few decades. Usually these have been for social, production management, or economic reasons. As milk production per cow and herd averages have increased, the interest in milking frequency and interval by dairy farm management has also increased. Practices which were considered to be common in the early part of the century, such as once a day milking, twice a day with intervals of 9-14 hours between milking, and even skip-a-milking a day, would not be considered as acceptable in present milking management of high producing cows. A review of past milking practices may help understand what and why about the practices of milking management used today.

Once-A-Day Milking

Milking a cow once a day still is a common practice in some areas of the world where maximum milk production is not always the goal. Once-a-day milking may be more acceptable in some social-labor relationships. It is also common where dairy cattle calve (seasonal) to coincide with the availability of feed. For example, the cows are grazed with the calves for approximately half the day, and then the calves are separated and the cows are milked by hand, usually just before the calf is returned to the cow. The effect of the calves frequent nursing during the day may stimulate milk production was suggested in a trial in 1963 at the University of Minnesota (24).

Even on today's modern dairy farms, with ice storms, blizzards, and other violent type storms, it is not uncommon to have power outages of over one day. What cows to milk first when the power returns is a management dilemma. The results from a research trial in 1963 (5) which omitted one and two milkings on a weekly basis would indicate that the middle to late lactation will decrease the largest percentage. This could suggest that they should be milked first after a short interruption of the normal milking procedure.

Once-a-day milking has occurred on many dairy farms

in the past, although not always a planned event. These unusual happenings, would occur on New Years morning or after a family celebration such as a wedding, were the favorite times of the once-a-day milking. The result of these once-a-day milkings have not been documented as to the loss of milk production.

A trial by Auburn University (5) reported that cows which had one milking a week omitted lost 7% of their milk production, and cows with two milkings a week omitted lost 14%. Similar results were reported by Illinois State University (27), with a loss of 7% for cows with one milking a week omitted.

In New Zealand and Australia, milking cows once-a-day in late lactation has been researched. In several trials (9) milk production losses of 18 to 35% have been reported. In a 1953 study at the University of Connecticut (16) cows in late lactation milked once a day produced 10.8 lb per day compared to 17.4 lb per day for twice-a-day cows on a 10-14-hour schedule.

Twice-A-Day Milking (2X)

2x milking is the most common milking schedule of dairy cattle. Only in the last 30 years has the practice of milking on 2x schedule been at twelve-hour intervals. Even today in Midwestern U.S. where the dairyman also is a crop farmer, milking on a 10 to 14-hour schedule is a common practice. In Europe, Australia, and New Zealand 12-hour milking schedule for 2x milking are not common practices. The major reason for the 10 to 14-hour milking interval is usually a social factor.

Research is not conclusive as to the benefits of a 12-hour interval as compared to a 10-14 schedule. In a 1963 Cornell study (34) cows milked at an 8- to 16-hour interval milked only 4.3% less than a 12-hour interval for 2x milking. In the same trial cows milked at a 10- to 14-hour interval produced only 1% less than a 12-hour interval, milk production per cow per year was 15,000 lbs of milk for the Cornell trial. In research trials with cows which had a relatively low daily milk production of 17-28 lb at the University of Minnesota in 1954 (20), New Zealand in 1956 (26) and Australia in 1955 (37), an unequal daily milking interval of 10 to 14 hours for 2x milking did not have a significant decrease in daily milk production when compared to a 12-hour interval. Level of milk production may have contributed to the results of these trials.



A more recent study by the University of Illinois (36) with cows milking over 70 lb of milk daily, a 2% decrease was observed with cows milked at a 9- to 15-hour interval as compared to cows milked on a 12-hour interval. It is an observation by the author (3) that dairy herds with a daily milk production of more than 60 lb per cow per day on a 10- to 14-hour interval would increase milk production 4 to 6%, when changing to a 12-hour schedule within two weeks of the change.

There is no data available from research trials on intervals between milking to indicate any effect on udder health of different intervals for 2x milking. Therefore, one could hypothesize that the present practice of milking high producing herds on a 12-hour interval for 2x milking will result in higher milk production.

Three-Times-A-Day Milking (3x)

Milking cows 3x has become a common milking frequency in recent years. From 1920 to 1950 milking 3x was usually done only on purebred registered herds to increase milk production on selected cows. The rising cost of facilities per cow, the increase in labor efficiency through parlor mechanization, and higher production per cow have increased the interest in milking 3x to improve the profitability of the dairy enterprise. A response percentage of 3 to 39% for cows changed from 2x to 3x milking intervals has been reported in research literature (6, 11, 14, 15, 25, 30, 31, 39). Management and facilities certainly have an important role in the percentage response to 3x milking. Nutrition requirements for any potential increase in milk production must also be met, with 3x herds being fed three times or more each day. Milking management and milking systems must be of top quality to assure udder health. Walking distance in the lane from the corral or housing area to the milking parlor should not exceed 600 to 700 feet, and group size should not exceed one hour of milking capacity of the parlor. The lack of proper facilities or management can result in a low response to 3x milking frequency.

An additional milking shift will increase labor requirements, although the total time required to milk the same herd size will be approximately 8 to 10% less for 3x than 2x herds (35). For example, a 2x herd which requires 8 hours per milking shift will require 8 to 10% less on 3x or a milking shift of 7 hours. For large dairy herds using hired labor for milking, the organization of the milking shift is less difficult than for smaller farms where family labor is used.

The response to 3x milking also varies by lactation number. In a comparison of seven herds in California in 1986 (1), the increase in milk production for first lacta-

tion cows was 19.4%, second lactation 13.5%, third lactation 11.7%, and four or more lactations 13.4%. Another California study in 1986 (13) analyzed monthly herd summaries of 28 herds prior to and for the first 36 months after switching to 3x milking and reported a 12% increase on 3x milking, with first lactation cows increasing 14% in milk yield. In an Arizona study (23) of DHIA records on herds changing from 2x to 3x increased 15% in milk yield within 12 months after changing milk frequency. In a Connecticut study in 1977 (14) of six herds which changed from 2x to 3x, milk yield was increased 7% for second lactation cows and older, and 11% for first lactation cows above their projected 2x yield. British research (32) evaluated 3x milking during the first 20 weeks of lactation and reported an increased milk yield of 19% for multiple lactation cows and 13% for first lactation cows.

The majority of research studies on 3x milking have been to measure milk production. There is less data on the effects of milking on reproduction and udder health, and the data is not conclusive. No effect of 3x milking on reproduction performance was reported in a Georgia research trial in 1985 (2). A California trial in 1986 (1) reported a difference in reproductive performance by lactation number for cows milked 2x vs 3x. Cows during the first lactation milked 3x had more breeding and days open than 2x milked cows, second lactation and more cows showed no difference in days open for 3x vs 2x cows. De Peters et al. in 1985 (10) reported a trend for reproductive performance of 3x milked cows to be poorer than cows milked 2x a day. Gisi et al. in 1986 (13) reported a trend in reduced reproductive efficiency for 3x cows when compared to 2x cows, with days to first breeding less for 3x cows. Cows during the first and second lactation milked 3x had more breeding (0.2) than 2x milked cows; with no difference in

third and fourth lactation. Some research reports have suggested that higher milk yields adversely affect reproduction efficiency of cows, even of cows milked 2x (21, 29).

A summary of previous research data would indicate that reproduction efficiency may be lower during the first two lactations for 3x milked cows with no effect on later lactation cows. The decrease in reproductive efficiency if lower is very small and in most of the trials was not statistically significant. Cow longevity was evaluated in the 1986 California trial (1), with fewer cows being culled from the herds milking cow 3x vs. the 2x herds.

Udder health was not affected by 3x milking in a number of research trials. a California trial in 1986 (13) reported no difference in California mastitis test scores.

Pearson et al (30) reported no difference in udder health for 3x milked cows. When compared to 2x cows in a 1983 trial by Kentucky research workers (39) somatic cell count was lower, and there was no difference in the number of new bacterial infections between 3x and 2x milked cows.

Therefore, if a dairy farm has properly installed and maintained milking equipment and acceptable milking practices, no increase in somatic cell count or clinical mastitis should occur. In conclusion, if herds are well managed 3x milking should increase milk production by 10 to 18%, reproduction efficiency in first and second lactation cows may be slightly lower, and somatic cell count and clinical mastitis may be lower. Conversely, in poorly managed herds or herds with inadequate facilities for 3x milking, this may only aggravate existing problems and would not be advantageous.

Two-And-A-Half-Times-A-Day Milking?

Many dairymen have pushed their facilities past the time necessary to milk all their cows either 3x or 4x. For example, a herd may require 27-28 hours to complete 3x milking. Although there is little research to study the effect of these types of milking intervals, such as 2=x, research in Holland (18, 19) would indicate that a cow does have a biological clock. That is, a cow will have higher milk production if she is milked and fed on the same daily routine. Therefore, if the time of milking is moved 3 to four hours each day, the benefits of the increased frequency in milk production will be reduced. If your milking frequency is 2=x you do not get one-half the benefit of 3x milking. If a dairyman is milking more cows than the milking parlor and labor can milk in a 24-hour period, it probably is preferable to decrease the milking frequency so that milking and feeding are done on the same routine each day.

Four-Times-A-Day Milking (4x)

4x milking is not a new milking practice. There are more research reports prior to 1940 on 4x milking than 3x milking. The practice of milking cows 4x for a short period of time, one to two weeks before a 24-hour milk recording period, was common for registered herds. Many of the high individual lactation production records were with 4x milking. There are also research reports of 4x milking for the entire lactation (8, 12, 28) with increases of 5 to 12% for cows milked 4x when compared to 3x. Although the milk production in these research reports were not as high as present milk production, it would have been considered high at the time.

A Danish report of high producing cows in Denmark in 1944 (22) compared 4x milking to 3x with a 15% increase in milk production. Hillerton et al. in England in 1990 (17) found a 12% increase in milk yield in a split-udder trial at approximately 150 days postpartum. More recently dairy herds in Washington, Idaho, New York, and Arizona have used 4x milking for several years or for short periods of time when milk price or milk quotas would make the practice profitable. The effects of milking 4x on milk production was 29-30% from 2x and 9-14% from 3x reported by Armstrong (4) for the first month after changing. In Holland cows being milked in a Robotic milking system (19), where cows had access to a milking stall 24 hours a day, 83% of the cows would voluntarily enter the stall between 3 to 5 times a day, with the average being 3.9 milkings per day, but 17% of the cows with a 16% increase over 2x milking did not volunteer to be milked at all. One large Saudi Arabia dairy company with over 16,000 cows in several herds has been milking 4x for over five years (3). Their November 1996 herd average of milk sold per cow per year is 25,752 lb of milk, with a very low daily rate of 0.20% of clinical mastitis. The maximum walking distance to the parlor for these herds is less than 425 feet. In the Danish (22) with cows which were milked 4x for over three years there was no effect on udder health or longevity.

Hillerton et al. (17) found that somatic cell count of cows which were changed from a 2x milking frequency to 4x increased during the first four days after the change then returned to the original level, which was less than 100,000. Clinical mastitis was also lower in the 4x cows. Lower cell counts with more frequent milkings have also been reported from Dutch studies (33). Observations of herds in the U.S. and Saudi Arabia would indicate that with cows being milked 4x that the size of the top of inflation could influence teat-end conditions (3). using a liner with the size less than 21 mm or a silicon liner, the incidence of teat-end erosion was reduced on cows being milked 4x. Although there did not seem to be a correlation between severity of teat end erosion and the rate of clinical mastitis.

The profitability of milking 4x will be influenced by feed cost, milk price, and labor cost, with the expected percent increase less than 3x.

5x Or 6x Milking?

Milking cows 6x (7, 38) resulted in an increase of 9 to 10% in milk production when compared to 3x milking, with no increase in milk production in middle lac-



tation cows. Somatic cell count increased three-fold for the first two days of the experiment and then returned to normal. In the Israeli trial in 1992 (7), cows were milked 6x in the first six weeks postpartum and compared to 3x cows. Peak milk yields were higher for the 6x cows (94 lb), and 79 lb for the 3x. Dry matter intake was higher, daily body weight loss was greater, and body condition score loss was also greater. All cows were milked 3x after week six. Milk yield and dry matter intake remained higher. Gain of body weight and body condition score of the early 6x cows was delayed approximately 4 weeks. The number of pregnant cows was also lower in the 6x group after 120 postpartum. In several short-term experiments of 7 weeks in England (17), 5x milking only increased milk production (5.8 to 8.0%) over 2x milking with cows averaging 46 lb of milk per day. Teat end condition score of cows milked more frequently than 4x would indicate that an interval of more than five hours between milkings is necessary to maintain a healthy teat end.

Conclusions

1. Once-a-day or skipping a milking is not acceptable with high production dairy cows under intensified dairy systems.
2. Twice-a-day milking with intervals of 10-14 and 12-12 are acceptable with very little research information as to the benefit of the 12-12 interval.
3. Three-times-a-day milking will increase milk pro-

duction 10 to 18% over 2x. Reproductive efficiency will be slightly lower, and udder health may be improved.

4. Four-times-a-day milking will increase milk production 8 to 12% over 3x. Udder health will be improved, with no data available on reproductive efficiency.

5. When changing from 3x to 2x or 4x to 3x, dairy farm managers should not expect to see a 8 to 15% decrease in milk products. Research has shown (30, 32) that after 20 and 14 weeks of an increased frequency of milking there is a carry-over effect of 9 to 11%, which is the effect of lactation persistency.

6. Superior facilities and management are necessary to receive the height percentage increase from either 3x or 4x milking frequency.

7. Keep the daily milking and feeding schedule the same each day. Do not milk 3x or 4x with more cows than the capacity of the milking parlor capability in a 24-hour period.

8. Financial benefits of milking frequency greater than twice a day will be affected by feed cost, milk price, and labor cost.

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Notes: